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Title: *"Regarding Sun-Earth-Asteroid systems as perturbed two-centre systems"*

Abstract. The Law of Universal Gravitation, according to which, any two masses in the Universe attract each other with a law going as the inverse squared distance, was stated in 1687 by Isaac Newton. Newton was aimed to find a theoretical explanation to the Kepler's Laws (1609–1619). At the same time, he provided the *exact solution* of the simplest gravitational system: the two–body problem, or: the problem of Sun and Earth. He also tried to attack the analogous problem with three masses: Sun, Earth and Moon, but then gave up, calling it a "head ache problem". At the end of the XX century, Henri Poincaré proved the *non–integrability* of the three-body problem, and this led him to formulate the concept of *chaos* in dynamics. A major breakthrough came from Kolmogorov–Arnold–Moser theory (1954, -62, -63), the main object of which was that of providing an estimate of "stable motions", from the probabilistic point of view.

Much less known as further example of *exactly solved* gravitational system is the so–called two–centre problem, solved by Euler in XVIII century. Maybe due to the difficulty of handling, at practical level, Euler's solutions, the two–centre problem has been not frequently used in the study of the three–body problem. An attempt in this direction is often attributed to Charlier. The aim of this talk is to discuss a canonical setting that allows to do that in a seemingly not too complicate way, at least in the case that the three masses are much different one from the other (Sun, Earth and an Asteroid). As a by-product, we shall show that, with our method, it is possible to characterize exactly collisions Earth-Asteroids in terms of the levels of a quasi-integral associated to it, and to prove the global existence of a plenty KAM tori even when the orbits of the asteroid encircles the Earth, a situation at risk of collisions. Moreover, the analysis highlights the possibility of Arnold diffusion.